Open Access

SCHOLARENA

Journal of Advancements in Plant Science

RESEARCH ARTICLE

Utilization of Medicinal and Aromatic Plants in Dairy Products

Kaptan B*, Sivri GT

Faculty of Agriculture, Department of Food Engineering, Namık Kemal University, Turkey

***Corresponding author:** Kaptan B, Faculty of Agriculture, Department of Food Engineering, Namık Kemal University, 59030, Turkey, Tel:+90 282 250 2163, E-mail: bkaptan@nku.edu.tr

Citation: Kaptan B, Sivri GT (2018) Utilization of Medicinal and Aromatic Plants in Dairy Products.J Adv Plant Sci 1: 207

Abstract

The number of plants used to give flavor, aroma, odor and color to food currently exceeds 20,000. The availability of new areas of use and the increase in the demand for natural products increase the use of these plants day by day. They can be used raw or cooked, dried, brined or pickled. Medical and aromatic plants, in addition to their aromatic properties such as taste and aroma, can show functional properties such as antioxidant, anti-inflammatory, antiallergic, antidepressive and antimicrobial effects, depending on the active substances in their content. With these properties, they can also be used as spices, food supplementary and additives. Thyme (*Thymus vulgaris*), coriander (*Coriandrum sativum*), peppermint (*Mentha piperita*), coconut (*Cocos nucifera*), cinnamon (*Cinnamomum zylancium*), cumin (*Cuminum cyminum*), rosemary. (*Rosmarinus officinalis*), black pepper (*Piper nigrum*) and garlic (*Allium sativum*) are aromatic plants commonly used in ayran (*Turkish traditional yoghurt drink*), yoghurt and various cheese types. In addition to their taste and aromatizing uses in dairy products, bioactive molecules extracted from medicinal plants can be used as natural preservative additives due to their antimicrobial and antioxidant activity.

Keywords: Medical Aromatic Plants; Dairy Products; Antimicrobial; Antioxidant

Introduction

Using aromatic plants as nutrients dates back to ancient times, and the terms "medical" and "aromatic" plants are commonly used together. Aromatic plants have a wide range of using area. Plant species rich in secondary components (alkaloids, essential oils, glycosides, flavonoids, tannins, phenols, coloring agents and resins) are in the group of medical and aromatic plants [1,2]. They are used fresh and dry and have many different forms of use including plant parts such as leaves, roots, flowers, seeds, crusts, tubers or herbs, as well as crushed or grounded forms, and extracts prepared in different ways [3]. Medical and aromatic plants are used for aromatic, coloring, preservative and antioxidative purposes as spice and food additives, thanks to their functional properties. Their natural antioxidant properties were benefitted in their safe use against synthetic antioxidants due to the increasing concerns about the reliability of synthetic antioxidants; the food industry has shown an intense interest on obtaining natural antioxidants from various plant materials. Thyme (*Thymus vulgaris*), coriander (*Coriandrum sativum*), peppermint (*Mentha piperita*), coconut (*Cocos nucifera*), cinnamon (*Cinnamomum zylancium*), cumin (*Cuminum cyminum*), rosemary (*Rosmarinus officinalis*), black pepper (*Piper nigrum*) and garlic (*Allium sativum*) can improve sensory properties such as aroma, taste, color and general quality in dairy products [4-13]. They can be effectively used as powerful alternatives to synthetic and chemical antimicrobial agents as natural preservatives thanks to their antimicrobial effects, as well as their use in dairy products for taste and aroma purposes (Table 1). The potent antioxidant properties of thyme in butter, and the use of safflower in the production of ice cream as natural carthamidine dye obtained from its yellow pigments in petals increase the added value of these products. The antimicrobial effect of thyme essential oils against *Listeria monocytogenes, Staphylococcus aureus, Lactobacillus sake, Lactobacillus plantarum, Yersinia enterocolitica, Pediococcus acidilactici, Pediococcus pentosaceus and Micrococcus luteus and the antimicrobial effects of mint, cumin, fennel and bay essential oils against Escherichia coli, S. aureus, P. aeruginosa, Proteus vulgaris* and *Bacillus subtilis* are important in terms of the microbial quality of products [11,14-19].

The purpose of this paper is to provide an overview of the published data on the some of medicinal and aromatic plants used for protective, taste and aromatic purposes in dairy products, and describe the possible modes of action that could be considered suitable for application.

Functional Properties

Antimicrobial properties

Secondary metabolites found in the structure of aromatic plants are important considering their antibacterial properties. The lipophilic properties of these plants causing antibacterial activities originate from terpenoids (isoprenoids), monoterpenes and sesquiterpenes, low molecular weight aliphatic hydrocarbons, acids, alcohols, aldehydes, acyclic esters or lactones, and as an exception, nitrogen and sulfur containing compounds, coumarins and phenylpropanoids [20]. Their antibiotic and antiseptic properties were effective on certain bacteria such as *L. monocytogenes, E. faecalis, Staphylococcus spp., Micrococcus spp., Bacillus spp., Campylobacter jejuni, Vibrio parahaemolyticus, Pseudomonas fluorescens, Shigella spp., E. coli, yeast and molds (Saccharomyces cerevisiae, Aspergillus flavus, Aspergillus parasiticus*) causing food spoilage and poisoning [15]. It has been stated that gram-negative bacteria are more resistant to the antimicrobial properties of essential oils compared to gram-positive bacteria, and this resistance of gram-negative bacteria may be due to their cell walls. It has been observed that the antimicrobial effects of aromatic and phenolic compounds are based on their ability to disrupt cell wall and cytoplasmic membrane, leading to the disruption of cell membrane, increased membrane permeability, leading to lysis and leakage of intracellular compounds [21].

Antioxidant properties

The antioxidative properties of plants are due to the phenolic hydroxyl groups present in the structure of their constituents. As natural antioxidants, especially polyphenols and carotenoids [22,23] they exhibit a wide range of biological effects including anti-inflammatory, anti-aging, anti-atherosclerosis and anticarcinogenic effects. Antioxidations are important for nutrition because they reduce physiological stress in organs and cells [24-26]. During oxidation, many compounds such as peroxides, hydrocarbons, aldehydes, ketones, alcohols and acids are formed and consequently, food becomes bitter and loses its sensory properties, the nutritional value of the product decreases and the shelf life is shortened. Synthetic antioxidants are commonly used in food processing to extend the shelf life of food. Research has suggested that synthetic antioxidants such as butylated hydroxytoluene (BHT) and butylated hydroxy anisole (BHA) used in food processing show a carcinogenic effect on living organisms [27]. This has led to an increased use of medicinal and aromatic plants, which have a great potential as natural antioxidant sources, to prevent oxidation in fatty foods such as meat, milk and bakery products.

Aromatic Plants Used in Dairy Products

The major problems encountered during the preservation and storage of products is microbial contamination and lipid oxidation. Natural antimicrobial and antioxidant plants are known to be extremely safe compared too many other synthetic antimicrobials and antioxidants. Aromatic plants used in imparting flavor and aroma in dairy products are also effective in increasing the nutritional value of the product and in extending its shelf life. Many researchers suggest that essential oils of aromatic plants and some certain plants may be used as food preservatives.

Thyme (*Thymus vulgaris*)

Thyme is a small, perennial plant that surrounds the ground and can rarely grow up to 40 cm. It blossoms in summer and contains vitamin A, vitamin C, iron, manganese and copper minerals. The plant is characterized by a sharp aroma resulting from the essential oils in its leaves, which give its characteristic taste and medical properties. Thymol, which is the main essential oil component of thyme, is widely used in liquor, perfume and medicine production. In food industry, it is used as a preservative in meat and butter. In a study on the antioxidant effects of thyme in butter, it was determined that butter containing thyme had potent antioxidant effects originating from the thymol, carvacrol, p-cymene content of the plant [6].

The researchers determined that thyme was the most effective plant preventing the growth *of E. coli* [28]. It has antibacterial effects on *Salmonella and Staphylococcus species* and strengthens the immune system, thanks to its antiseptic properties [29]. The ethanol extract of the leaf of the plant showed the best inhibition zone *against P. aeruginosa.* In a study, essential oils of six different spices were applied directly at two different ratios against eight different bacterial strains (*L. monocytogenes, S. aureus, L. sake, L. plantarum, Y. enterocolitica, P. acidilactici, P. pentosaceus, M. luteus*) and, the highest antimicrobial activity was detected in the thyme essential oil, compared to those of others [30].

Dill (*Anethum graveolens*)

One of the most useful spices as well as medicinal plants is *Anethum graveolens L.* which is commonly known as dill, is an annual aromatic herb belonging to Gravolens family. Dill contains essential oil in its leaves, stem, flowers and fruits. Thoroughly chopped fresh dill leaves are aromatic plant parts widely used to give flavor and aroma in kefir, yoghurt and sour cream. It is used in cheese making by adding to the curd. Seventeen volatile compounds were identified from the seeds, leaves and flowers of that plant. The main components are monoterpenes containing 40 to 60% d-karvone (23.1%) and d-limonene (45%) [31,32]. The essential oils of dill have antimicrobial activity against *S. aureus, Salmonella sp.* and *E. coli* and reduced the growth of *L. monocytogenes.* Antifungal and antibacterial effects were studied by using various foods [16]. An inhibitory effect was detected on *Penicillium verrucosum* which causes deterioration in cheese. The total phenolic contents of fresh dill changes between 129 and 1250 mg GAE and it was

determined that it has the highest total polyphenol levels [33-35]. Compared to different cheese samples, dill cheese has high total phenolic compound contents with 37.82 mg of GAE/100 g. Phenolic compounds found in the plant's structure contribute to the antioxidant activity of the cheese. Dill has a specific taste and odor in addition to the relatively high amounts of vitamin C, chlorophyll and carotenoid in its content compared to those of other leafy plants [36].

Basil (*Ocimum basilicum*)

It is a white, herbaceous plant with purple flowers and grows annually and generally in temperate regions. Fresh flowering branches and seeds of the plant are used. Essential oil content is composed of estragol, linalol, cineol and pinen, depending on geographical conditions [37]. Leaves can be used fresh or dried and used as spices. The main phenolic compounds in basil are phenolic acids and flavonol-glycosides [38]. Basil has antimicrobial, antifungal and antioxidant effects originating from its phenolic and aromatic compounds [39-41]. Basil seed gum, as a surface-active polysaccharide, is used both as an emulsifier agent and as a stabilizer agent and its use in low fat ice cream production to improve the rheological properties yielded positive results in sensory evaluations [9,10]. It is also used to preserve the rheological, physical and sensory properties of cheese [10]. Due to the importance of basil bioactive compounds, its functional and protective properties was evaluated and it was used as a natural and suitable ingredient in the production of Serra da Estrela cheese Basil supplementation which have yielded positive results in prevention of peroxidation in proteins and unsaturated fatty acids, and avoiding moisture loss in cheese [12].

Anthriscus (*Anthriscus nemorosa*)

Also known as Chervil it is a wild plant found in warm regions [42]. It is found on road sides and in woodlands [43]. It was reported to have an antibacterial activity on *E. coli, S. aureus* and *Helicobacter pylori* [44]. It is widely used to add flavor and aroma in the production of Van herbed cheese [4]. Out of 18 essential oils, its main components were determined as β-caryophyllene (23.6%), caryophyllene oxide (12.3%), δ-cadinene (12.1%), and trans pinocarveol (9.8%) [45].

Chives (*Allium schoenoprasum*)

Sirmo is an herbaceous perennial plant. Its length can reach 30 centimeters. Its flowers are usually pink and white. It is also called cheese herb, leaf onion and French onion. It shares similarities with garlic regarding the common medicinal properties and it contains organosulfur compounds, such as allyl sulfides and alkyl sulfoxides. It is an antimicrobial plant with a taste and aroma similar to those of garlic [46]. Another large group of bioactive substances of great importance in human nutrition include sulfur-free polyphenolic compounds including anthocyanins, flavonols, tannins, flavonoids, phenolic acids, phytosterols, carotenoids and saponins [2,47]. It is used in making herbed cheeses in the Eastern and Southeastern Anatolia. Chives adds traditional taste and nutritional value to cheese.

Rosemary (*Rosmarinus officinalis*)

The rosemary is a thin-leafed, evergreen plant with purple flowers and a bushy appearance. It is widely grown around the Mediterranean region; its young shoots are used as spices. It is widely used as dried or fresh to give flavor and aroma to foods. Rosemary contains caffeic and rosmarinic acids as well as flavones, phenolic diterpenes and hydroxycinnamic acid ester and it has a high antioxidant activity [48]. It was determined to have antibacterial activity against *S. typhimurium, E coli, S. aureus and L. monocytogenes* [17]. Dried leaves contain 2-4 times more phenolic content than fresh leaves. Its anti-radical capacity was reported to be 17.1 - 26.4 mmol /100 g, according to the FRAP method. The use of dried and fresh leaves in the production of cottage cheese gives cheese its aroma [8]. It increases the antioxidant properties in cheese and used in mixture with other herbs in the production of herbed cottage cheese and herbed cheese. It is also used to give flavor and aroma to yoghurt.

Garlic (*Allium sativum*)

Garlic is an herbal product, which recently gained attention with its strong antimicrobial effects. It has inhibitory effects on E. coli, S. aureus, L. monocytogenes and S. typhi [49]. Studies, have reported that sulfur-containing compounds found in the garlic structure are effective in inhibiting the formation of carcinogenic compounds by converting nitrides, which are necessary for the formation of carcinogenic compounds, and nitrosamines to nitrosothiols [50]. It is commonly used in cheese and yogurt for taste and aroma purposes. The addition of 3% garlic powder in cottage cheese led to a decrease in coliform bacteria, yeasts and mold counts [5]. The total phenolic content of fresh garlic with low polyphenol content was determined as 59.4-74.1 mg of GAE / 100 g [51].

Turmeric (*Curcuma longa*)

Turmeric has anti-inflammatory antioxidant, anticancer, antidiabetic, antiallergic, antiviral, antiprotozoal and antifungal properties [7,52-58]. Curcuminoid, a potent antioxidant, prevents cancer formation by inhibiting tumor formation in the initial phase. It promotes neuroprotective activity and helps protecting the cardiovascular system [59]. Turmeric addition to cheese milk had positive effect on the taste and shelf-life of Karish cheese. It exhibited a 1 log inhibition in *S. typhi,* 2 log inhibition in E.coli 0157:H and completely inhibited *S .aureus, B .cereus and L. monocytogenes* at the end of a 14 day-long storage [11].

Coriander (*Coriandrum sativum*)

Also known as cilantro or Chinese parsley, both the seeds and the leaves of coriander are used as spices. The leaves are consumed green and fresh. Coriander is similar to parsley and it is a 20-60 cm high, annual, herbaceous plant. Its green leaves contain protein, vitamins and minerals (such as calcium, phosphorus and iron), fiber and carbohydrate, rich in various components that provide a typical flavor [60]. Its fatty acid composition consists of petrozinic acid (68.8%), linoleic acid (16.6%), oleic acid (7.5%) and palmitic acid (3.8%) [61,62]. With its antibacterial, antifungal, and anti-oxidative activities, it prevents food degradation [14-19, 63]. It is used as a mixture with other aromatic herbs in the production of herbed cheese and herbed cottage and it is used to give taste and aroma in yogurt, fresh and cream cheese.

Conclusion

The antibacterial and potent antioxidant effects of plants result from the phenolic compounds in its content, which are bioactive compounds. Fresh or dried herbs that will be added to dairy products to impart flavor and aroma will slow the proliferation of microorganisms, and extracts from plants will be beneficial in terms of increasing the diversity and functionality of bioactive compounds as natural preservatives and antioxidants.

Acknowledgement

Part of this study was presented as an oral presentation at International Conference on Agriculture, Forest, Food Sciences and Technologies (ICAFOF), 15-17 May 2017, Cappadocia / Turkey. Only the abstract of the study was published in the abstract book of International Conference on Agriculture, Forest, Food Sciences and Technologies (ICAFOF), 15-17 May 2017, Cappadocia / Turkey.

References

1. Veeru P, Kishor MP, Meenakshi M (2009) Screening of medicinal plant extract for antioxidant activity. J Med Plants Res 3: 608-12.

2. Shawal PD, Patil GR, Singh RRB, Arvind K, Ghule KA (2012) Potential application of milk and milk products as carrier for herbs and nutraceuticals. Current Topics in Nutraceutical Res 10: 101-10.

3. Alezandro MR, Lui MCY, Lajolo FM, Genovese MI (2011) Commercial spices and industrial ingredients: evaluation of antioxidant capacity and fl avonoids content for functional foods development. Ciência Tecnol Aliment 31: 527-33.

4. Tarakci Z, Coskun H, Tuncturk Y (2004) Some properties of fresh and ripened herby cheesea traditional variety produced in Turkey. properties of Herby Cheese. Food Tech and Biotech 42: 47-50.

5. Regu M, Yilma Z, Seifu E (2016) Effect of garlic (Allium sativum) and ginger (Zingiber officinale) powder on chemical composition and sensory property of Ayib - Ethiopian cottage cheese. Inter Food Res J 23: 1226-32.

6. Ozkan G; Simsek B, Kuleasan H (2007) Antioxidant activities of satureja cilicia essential oil in butter and in vitro. J Food Eng 79: 1391-6.

7. Menon VP, Sudheer AR (2007) Antioxidant and antinflammatory properties of curcumin In: Aggarwal BB, Surh YJ, Shishodia S, The Molecular Targets and Therapeutic Uses of Curcumin in Health and Disease. Boston, MA: Springer US 105-25.

8. Josipović R, Knežević ZM, Frece J, Markov K, Kazazić S, Mrvčić J (2015) Improved properties and microbiological safety of novel Cottage Cheese containing spices. Food Tech and Biotech 53: 454-62.

9. Javidi F, Razavi SMA, Behrouzian F, Alghooneh A (2016) The influence of basil seed gum, guar gum and their blend on the rheological, physical and sensory properties of low fat ice cream. Food Hydrocolloids 52: 625-33.

10. Hosseini-Parvar SH, Matia-Merino L, Golding M (2015) Effect of basil seed gum (BSG) on textural, rheological and microstructural properties of model processed cheese. Food Hydrocolloids 43: 557-67.

11. Hosny I M, El Kholy W I, Murad H A, El Dairouty R K (2011) Antimicrobial activity of curcumin upon pathogenic microorganisms during manufacture and storage of a novel style cheese 'Karishcum". J American Sci 7: 611-8.

12. Carocho M, Barros L, Barreira JCM, Calhelha RC, Soković M et al. (2016) Basil as functional and preserving ingredient in "Serra da Estrela" cheese. Food Chem 207: 51-9.

13. Oraon L, Jana A, Prajapati PS, Suvera P (2017) Application of Herbs in Functional Dairy Products – A Review. J Dairy Vet Anim Res 5: 00145.

14. Teshale C, Hussein J, Jemal A (2013) Antimicrobial activity of the extracts of selected Ethiopian aromatic medicinal plants. Spatula DD 3: 175-180.

15. Reichling J (2010) Plant-microbe interactions and secondary metabolites with antibacterial, antifungal and antiviral properties: Functions and Biotechnology of Plant Secondary Metabolites Annual Plant Rev 39: 214-347.

16. Rafii F, Shahverdi AR (2007) Comparison of essential oils from three plants for enhancement of antimicrobial activity of nitrofurantoin against Enterobacteria. Chemotherapy 53: 21-5.

17. Leng TW, Idayu Muhamad I, Abang Zaidel DN, Khairuddin N (2013) Evaluation of capsaicinoids extracts as bioactive substance for antimicrobial films. J Tech Sci and Eng 64: 69-74.

18. Kumar M, Berwal JS (1998) Sensitivity of food pathogens to garlic (Allium sativum). J Appl Microbiol 84: 213-5.

19. Keskin D, Toroglu S (2011) Studies on antimicrobial activities of solvent extracts of different spices. J Environ Biol 32: 251-6.

20. Djilani A, Dicko A (2012) The therapeutic benefits of essential oils, Nutrition, Well-Being and Health, Dr. J. Bouayed (Ed.), InTech 5: 155-78.

21. Bakkali F, Averbeck S, Averbeck D, Idaomar M (2008) Biological effects of essential oils – A review. Food and Chem Tox 46: 446-75.

22. Baiano A, Del Nobile MA (2016) Antioxidant compounds from vegetable matrices: Biosynthesis, occurrence, and extraction systems. Critical Reviews in Food Sci and Nutr 56: 2053-68.

23. Manach C, Scalbert A, Morand C, Rémésy C, Jiménez L (2004) Polyphenols: food sources and bioavailability. American J Clin Nutr 79: 727-47.

23. Manach C, Scalbert A, Morand C, Rémésy C, Jiménez L (2004) Polyphenols: food sources and bioavailability. American J Clin Nutr 79: 727-47.

24. Li AN, Li S, Zhang YJ, Xu XR, Chen YM, et al. (2014) Resources and biological activities of natural polyphenols. Nutrients 6: 6020-47.

25. Zhang YJ, Gan RY, Li S, Zhou Y, Li AN, et al. (2015) Antioxidant phytochemicals for the prevention and treatment of chronic diseases. Molecules 20: 21138-56.

26. Salomone F, Godos J, Zelber-Sagi S (2016) Natural antioxidants for non-alcoholic fatty liver disease: molecular targets and clinical perspectives. Liver Int 36: 5-20.

27. Ames BM (1983) Dietary carcinogens and anticarcinogens: Oxygen radical and degenerative diseases. Science. 221: 1256–1264.

28. Amrita V, Sonal D, Shalini R (2009) Antibacterial effect of herbs and spices extract on Escherichia coli. Elect J Biology 5: 40-4.

29. Shabnum S, Wagay MG (2011) Essential oil composition of Thymus vulgaris L. and their uses. J Res and Develop 11: 83-94.

30. Çon AH, Ayar A, Gökalp HY (1998) Antimicrobial activity of the essential oils extracted from some spices. Food 23: 171-5.

31. Bouwmeester HJ, Gershenzon J, Konings MCJM, Croteau R (1998) Biosynthesis of the monoterpenes limonene and carvone in the fruit of caraway. I. Demonstration of enzyme activities and their changes with development. Plant Physiol 117: 901-12.

32. Santos PAG, Figueiredo AC, Lourenço PML, Barroso, JG, Pedro LG et al. (2002) Hairy root cultures of Anethum graveolens (dill): establishment, growth, time-course study of their essential oil and its comparison with parent plant oils. Biotech Letters 24: 1031-36.

33. Lisiewska Z, Kmiecik W, Korus A (2006) Content of vitamin C, carotenoids, chlorophylls and polyphenols in green parts of dill (Anethum graveolens L.) depending on plant height. J Food Comp and Anal 19: 134-40.

34. Luthria DL, Mukhopadhyay S, Kwansa AL (2006) A systematic approach for extraction of phenolic compounds using parsley (Petroselinum crispum) flakes as a model substrate. J Sci Food and Agri 86: 1350-58.

35. Shyu YS, Lin JT, Chang YT, Chiang CJ, Yang DJ (2009) Evaluation of antioxidant ability of ethanolic extract from dill (Anethum graveolens L.) flower. Food Chem 115: 515-21.

36. Kmiecik W, Gębczyński P, Jaworska G (2001) Effect of the cultivar, usable part and growing period on the content of selected antioxidative components in dill (Anethum graveolens L). Acta Agraria et Silvestria 39: 35-48.

37. Chalchat JC, Ozcan MM (2008) Comparative essential oil composition of flowers, leaves and stems of basil (Ocimum basilicum L) used as herb. Food Chem 110: 501-3.

38. Lee J, Scagel CF (2009) Chicoric acid found in basil (Ocimum basilicum L.) leaves. Food Chem 115: 650-6.

39. Hussain A, Anwar F, Sherazi ST, Przybylski R (2008) Chemical composition, antioxidant and antimicrobial activities of basil (Ocimum basilicum) essential oils depends on seasonal variations. Food Chem 108: 986-95.

40. Politeo O, Jukic M, Milos M (2007) Chemical composition and antioxidant capacity of free volatile aglycones from basil (Ocimum basilicum L) compared with its essential oil. Food Chem 101: 379-85.

41. Flanigan PM, Niemeyer ED (2014) Effect of cultivar on phenolic levels, anthocyanin composition, and antioxidant properties in purple basil (Ocimum basilicum L). Food Chem 164: 518-26.

42. Altundag E, Ozturk M (2011) Ethnomedicinal studies on the plant resources of east Anatolia, Turkey. Procedia - Social and Behavioral Sci 19: 756-77.

43. Hultén E, Fries M (1984) Atlas of North European Vascular Plants North of the Tropic of Cancer. Koeltz Scientific Books: Königstein, Federal Republic of Germany 2: 694.

44. Cho E, Choi J, Kim H, Choi K, Ku J, et al. (2013) Antibacterial activity and protective effect against gastric cancer by Anthriscus sylvestris fractions. Hortic Environ Biotechnol 54: 326-30.

45. Hayta S, Dogan G, Demirpolat A, Bagci E (2015) Identification of essential oil composition of four umbelliferae from Turkey. Natural Sci and Discovery 1: 74-9.

46. Singh V, Singh D (2008) Pharmacological effects of Allium sativum L (garlic). Annual Review of Biomed Sci 10: 6-26.

47. Ma Y, Song D, Wang Z, Jiang J, Jiang T, et al. (2011) Effect of ultra-high pressure treatment on volatile compounds in garlic. J Food Process Eng 34: 1915-30.

48. Almela L, Sánchez-Muñoz B, Fernández-López JA, Roca MJ, Rabe V (2006) Liquid chromatographic–mass spectrometric analysis of phenolics and free radical scavenging activity of rosemary extract from different raw material. J Chromatography A 1120: 221-9.

49. Kumar M, Berwal JS (1998) Sensitivity of food pathogens to garlic (Allium sativum). J Appl Microbiol 84: 213-5.

50. Milner JA (2001) A historical perspective on garlic and cancer. J Nutr 131: 1027-31.

51. Bayili RG, Abdoul-Latif F, Kone OH, Diao M, Bassole IHN, et al. (2011) Phenolic compounds and antioxidant activities in some fruits and vegetables from Burkina Faso. African J Biotech 10: 13543-7.

52. Siddiqui AM, Cui X, Wu R, Dong W, Zhou M, et al. (2006) The anti-inflammatory effect of curcumin in an experimental model of sepsis is mediated by up-regulation of peroxisome proliferator-activated receptor-gamma. Critical Care Med 34: 1874-82.

53. Lotempio MM, Veena MS, Steel HL, Ramamurthy B, Ramalingam TS, et al. (2005) Curcumin suppresses growth of head and neck squamous cell carcinoma. Clin Cancer Res 11: 6994-7002.

54. Aggarwal BB, Sundarma C, Malani N, Ichikawa H (2007). Curcumin: The Indian solid gold. In Aggarwal BB, Surh YJ, Shishodia S (Edn), The Molecular Targets and Therapeutic Uses of Curcumin in Health and Disease. Boston 1-75.

55. Suzuki M, Nakamura T, Lyoki S, Fujiwara A, Watanabe Y, et al. (2005) Elucidation of anti-allergic activities of curcumin-related compounds with a special reference to their anti-oxidative activities. Biol Pharm Bull 28: 1438-43.

56. Si X, Wang Y, Wong J, Zhang J, McManus BM, et al. (2007) Dys regulation of the ubiquitin-proteasome system by curcumin suppresses coxsackievirus B3 replication. J Virology 81: 3142-50.

57. Reddy RC, Vatsala PG, Keshamouni VG, Padmanaban G, Rangarajan PN (2005) Curcumin for malaria therapy. Biochem and Biophys Res Communications 326: 472-4.

58. Chattopadhyay I, Biswas K, Bandyopadhyay U, Banerjee R (2004) Turmeric and curcumin: Biological actions and medicinal applications. Current Sci 87: 44-53.

59. Luthra PM, Singh R, Chandra R (2001) Therapeutic uses of curcuma longa (turmeric). Indian J Clin Biochem 16: 153-60.

60. Kalemba D, Kunicka A (2003) Antibacterial and antifungal properties of essential oils. Current Med Chem 10: 813-29.

61. Olle M, Bender I (2010) The content of oils in umbelliferous crops and its formation. Agronomy Res 8: 687-96.

62. Momin AH, Acharya SS, Gajjar AV (2012) Coriandrum sativum - Review of advances in phytopharmacology. Int J Pharma Sci and Res 3: 1233-9.

63. Sriti J, Wannes WA, Talou T, Vilarem G, Marzouk B (2011) Chemical composition and antioxidant activities of Tunisian and Canadian coriander (Coriandrum sativum L) fruit. J Essential Oil Res 23: 7-15.

64. Lu YR, Foo YL (2001) Antioxidant activities of polyphenols from sage (Salvia officinalis). Food Chem 75: 197-202.

65. Wahba NM, Ahmed AS, Ebraheim ZZ (2010) Antimicrobial effects of pepper, parsley, and dill and their roles in the microbiological quality enhancement of traditional Egyptian Kareish cheese. Foodborne Pathog Dis 7: 411-8.

66. Najgebauer-Lejko D, Grega M, Sady DJ (2009) The quality and storage stability of butter made from sour cream with addition of dried sage and rosemary. Biotech in Anim Husbandry 25: 753-61.

67. Buch S, Pinto S, Aparnathi KD (2014) Evaluation of efficacy of turmeric as a preservative in paneer. J Food Sci Tech 51: 3226-34.

68. Pinto SV, Patel AM, Jana AH, Solanky MJ (2009) Evaluation of different forms of ginger as flavoring in herbal ice cream. Int J Food Sci Tech Nutr 3: 73-83.

69. Trivedi V, Prajapati J, Pinto S, Darji V (2014) Use of basil (tulsi) as flavouring ingredient in the manufacture of ice cream. Am Int J Contemp Res 1: 28-43.

70. Mutlag A, Hassan E (2008) Improvement of the quality and shelf life of concentrated yoghurt (labneh) by the addition of some essential oils. African J Micro Res 2: 156-61.

71. Thabet HM, Nogaim QA, Qasha AS, Abdoalaziz O, Alnsheme N (2014) Evaluation of the effects of some plant derived essential oils on shelf life extension of Labneh. Merit Res J Food Sci and Tech 2: 8-14.